

CEE 3020 – Civil Engineering Materials Fall 2021

Lecture: MW 8:25 – 9:15 am
Coll of Computing 17

Laboratory: By section in 2140 Mason, with the exception of the Concrete Mixing Lab
Monday, Wednesday, or Friday: 12:30 – 3:15 pm or 3:30 – 6:15 pm

Instructor: Sheng Dai, Ph.D., P.E., Associate Professor in Geosystems Engineering
Contact: sheng.dai@ce.gatech.edu | (404) 385 4757 | Mason 2251
Office Hours: MW 11:00 am – 12:00 pm, or by appointment via email as needed
OH Location*: <https://bluejeans.com/493677332/6735>

Teaching Assistants	Office hours	Email	Office
Rashid Davis	MW 2pm-3pm	rdavis330@gatech.edu	Mason 2278
Wilson Espinoza	W10am-12pm	wespinoza6@gatech.edu	Mason 2131B
Lina Pua Pita	F 9am-11am	lpita3@gatech.edu	Mason 2141A
Candas Oner	T11am-1pm	candasoner3@gatech.edu	Mason 2254

Course Objectives

- To develop a competent understanding of the physical, mechanical, and other important properties of construction materials used in modern civil engineering applications.
- To understand relationships between nano/microstructure and macroscale material behavior (mechanical properties and durability)
- To build an awareness of common practices used in the manufacture, selection, and use of modern construction materials
- To develop an intuitive sense of material behavior through a series of hands-on laboratory exercises.
- To improve written technical communication skills

Required course materials:

- Materials for Civil and Construction Engineers, 4th Ed, Mamlouk & Zaniewski, Prentice Hall, 2017 (ISBN-13: 9780134320533)
- Lecture supplements, laboratory handouts, and other communication will be posted on Canvas.
- Homework problems will be given in the class, but *will not be collected nor graded*; however, the concepts covered in the homework will be used in the development of exams, so please be certain you understand all homework problems.

Additional Materials on Library Reserve:

Construction Materials:

- TA403 .S419 1998: J.F. Young, S. Mindess, R.J. Gray, A. Bentur, The Science and Technology of Civil Engineering Materials, Prentice-Hall, NJ, 1998. (Young)
- TA403.2 .D47 1998: Derucher, K.N., Korfiatis, G.P., and Elzedin, A.S., Materials for Civil & Highway Engineers, Prentice Hall, 1998.

Materials Science:

- TA403 .C23 2000: Callister, W.D., Materials Science and Engineering: An Introduction, John Wiley & Sons, 2007.

Aggregates, Cement, Concrete:

- TA439 .K665 2003: S.H. Kosmatka, B. Kerkhoff, and W.C. Panarese, Design and Control of Concrete Mixtures, 14th Ed., Portland Cement Association, Skokie, IL, 2003.
- TA439.M364 1993: P.K. Mehta and P.J.M. Monteiro, Concrete: Microstructure, Properties, and Materials, Prentice Hall, 1993.

Polymers and Composites:

- TA455 .P58 M334 1997: McCrum, N.G., Buckley, C.P., and Bucknall, C.B, Principles of Polymer Engineering, Oxford, 1997.
- TA418.9.C6 A34 2006: Agarwal, B.D., Broutman, L.J. and Chandrashekhara, K., Analysis and performance of fiber composites, John Wiley & Sons, 2006.

Wood:

- TA666 .S67 1997: Stalnaker, J.J. and Harries, E.C., Structural Design in Wood, VanNostrand-Reinhold, 1997.
- TA419 .W69: Wilcox, W.W., Wood as a Building Material, Wiley, 1991.

Grading:

Exam I	15%	Sept 22, 2021
Exam II	15%	Oct 27, 2021
Exam III	20%	Dec 15, 2021 @ 8:00 – 10:50 am
Laboratory Reports	50%	Periodically throughout the semester

Notes: In light of COVID, these dates are subjected to change.

Because laboratory exercises are an integral part of learning in this course, ALL lab reports are required to be submitted to receive a passing final grade.

Final Grades:

Final grades will be determined according to the following scale:

Course Average	Final Grade Will Be At Least *
Avg \geq 90	A
90 > Avg \geq 80	B
80 > Avg \geq 70	C
70 > Avg \geq 60	D
Avg < 60	F

* Assuming all Lab Reports are submitted prior to the end of the term.

Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. For information on Georgia Tech's Academic Honor Code, please visit <http://www.catalog.gatech.edu/policies/honor-code/> or <http://www.catalog.gatech.edu/rules/18/>.

All work submitted must be entirely your own work; any student suspected of cheating or plagiarizing on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty.

I do not consider it a violation of the honor code to use word to study for the exams. Group effort on laboratory reports will be considered a violation of the honor code.

Electronics Use Policy

You are strongly encouraged to avoid email, texts, tweets, social media, and all other electronic distractions during lectures. Engineering is difficult, and it requires a great deal of concentration and our dedicated focus. I firmly believe that as Civil and Environmental Engineers we perform one of the most, if not *THE* most critically important jobs in society. The world cannot function without us, and it is our responsibility to do this to the very best of our abilities.

Course Communications

- Information for the class will be posted by the instructors and TAs via the course website, accessed at <https://canvas.gatech.edu/>.
- Course forums moderated by the TAs will be held on Piazza <https://piazza.com/gatech/fall2021/cee3020b>. Students are encouraged to post questions on Piazza related to the labs, lectures, etc. Other students can earn extra credit by providing answers to these questions rather than just waiting on the TAs to answer. The TAs will be monitoring the boards and making note of those students who post correct and useful answers to questions the fastest. Before each test, the TAs will identify the student who they feel has done the best job answering other students questions and contributing to the student centered learning experience.
- The top participating student will be awarded 5 points of extra credit on the exam that follows. The TA's will also identify up to 2 other students who demonstrated exemplary participation. These other students will receive 3 points of extra credit on the exam that follows. Please note that weight will be given to correctly answered technical questions and TA's will be the final decision makers on who will receive extra credit.
- The official communication methods used by GT are email and Canvas; you are responsible for checking your GT email account and the course web site on Canvas regularly.
- Students are responsible for all technical information and announcements presented during lecture. If you are unable to attend a class, it is your responsibility to find out what you missed from a classmate.

Accommodations

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services at (404) 894-2563 or <http://disabilityservices.gatech.edu/>, as soon as possible, to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

COVID Campus Guidelines

Campus guidelines regarding vaccines, masks, testing, etc. are available at:

https://health.gatech.edu/tech-moving-forward#utm_source=gatech_home&utm_medium=banner&utm_campaign=coronavirus_campus

Course Outline

Weeks	Date	Lecture	Topic	Text reading
1	23-Aug	1	Intro	
	25-Aug	2	PCC	Ch.2.1, Ch.6, Ch.7.1
2	30-Aug	3	Aggregates	Ch.5
	1-Sep	4	Gradation	Ch.5.5
3	6-Sep		<i>Labor Day</i>	
	8-Sep	5	Portland Cement	Ch.6
4	13-Sep	6	Cement Hydration	Ch.6, Ch.7.2-7.5
	15-Sep	7	SCM	Ch.6.11
5	20-Sep	8	Chemical Admixtures	Ch.6.12
	22-Sep		<i>Exam I</i>	
6	27-Sep	9	ACI Mix Design	Ch7.1
	29-Sep	10	Properties of Concrete	Ch.7.2-7.5
7	4-Oct	11	Concrete Durability	Handouts
	6-Oct	12	Deterioration	Handouts
8	11-Oct		<i>Fall break</i>	
	13-Oct	13	Stress-Strain	Ch.1.2, Handouts
9	18-Oct	14	Atomic Structure	Ch.2.1-2.2, Handouts
	20-Oct	15	Microstructure of Metals	Ch.2.1-2.2
10	25-Oct	16	Macro Behavior of Metals	Ch.2.8-3.9, Ch.4.3
	27-Oct		<i>Exam II</i>	
11	1-Nov	17	Steel and Aluminum	Ch.3
	3-Nov	18	Fracture and Fatigue	Ch.3.9-3.11
12	8-Nov	19	Polymers	Ch.2.4
	10-Nov	20	RFP Materials	Ch.11.1, Ch.11.3
13	15-Nov	21	RFP Properties	Ch.11.1, Ch.11.3
	17-Nov	22	Wood	Ch.10
14	22-Nov	23	Wood Mechanical Properties	Ch.10
	24-Nov		<i>Student Recess</i>	
15	29-Nov	24	Asphalt Binders	Ch.9.1-9.7
	1-Dec	25	Asphalt Mixtures	Ch.9.8-9.14
16	6-Dec	26	Final Instructional Class	Review
	8-Dec			
17	13-Dec			
	15-Dec		<i>Final Exam: 8:00 am - 10:50 am</i>	

Notes on Assignments

The following formats are **REQUIRED** for all lab reports.

1. **ALL GRAPHS MUST BE COMPUTER GENERATED.** Hand drawn graphs will not be graded. Be careful to use scatter plots and not line graphs in order to obtain properly scaled axes.
2. Experimental data should be plotted as discrete points, while theoretical relationships should be shown as continuous lines.
3. **SHOW ALL UNITS.** Be certain to track units throughout the assignment and include them in the final answer.
4. One to three significant figures are normally sufficient in engineering. Due to the variability of naturally occurring materials, it is often impossible to calculate properties such as unit weight to ten decimal places, so do not report it to such precision (→ pay particular attention to your spreadsheets).
5. Clearly state any assumptions (such as an assumed specific gravity, unit weight, or density) you have made in calculations.

LABORATORY

Lab Safety: A signed lab safety form is required for each student at the beginning of the first lab exercise. The form is posted to Canvas. Also note that proper attire is required for each laboratory exercise – specifically, no open-toe shoes.

Summary of Laboratory Schedule: In total, five laboratory exercises will be performed with students working in groups of 4 to 5. The schedule, including meeting time and location, for these **mandatory** laboratory sessions are presented in Table 1. (If you have an unavoidable conflict for one of your mandatory lab sessions, you can petition the TA's *before* the lab meeting time to allow you to attend another lab session instead. Note that this will be allowed only in exceptional circumstances, and the TAs (with the Instructor's oversight) are the arbiters.

In addition to the regular laboratory meetings, there will be a sixth laboratory exercise designed and carried out by student groups (same groups as the other lab exercises) outside of the normal laboratory meeting time.

Laboratory Reports: Six laboratory reports will be prepared by each student, *working independently*. Generally, laboratory reports are due within 1 week of performing the lab (with some exceptions, see Table 1).

Note: While the experiments are typically performed in groups, the laboratory reports must be the result of individual effort, including the report text as well the creation/formatting of tables, figures and other graphics. Group effort on laboratory reports will be considered a violation of the honor code.

Laboratory reports must be prepared according to guidelines provided. Good technical writing and organization is expected; improvement over the course of the semester is also expected. See the posted "Lab Report Instructions" for more specific guidance on the preparation of lab reports for CEE 3020.

Grading will reflect performance in the following areas: consistency with organization and style guidelines (provided as a separate document), presentation and accuracy of results, correctness of

calculations, analysis and discussion of results, responses to specific questions posed by instructor, and formulation of conclusions. Specifically, the grading metric for Labs 1, 2, 3, 4, and 5 will be:

Report Section/Points	Earned Points
Abstract (10)	
Introduction (10)	
Experiment (5)	
Results (25)	
Discussion (25)	
Conclusion (10)	
Technical Writing (10)	
Graphics: Design (5)	
TOTAL (100)	

The grading metric for Lab 6 will be slightly different, and will be given out later in the semester.

Attached to the back of your lab report (as appendices) should be the raw data sheets completed in lab and signed by the TAs. Failure to turn in your data sheets with each lab will result in a blank grade in the gradebook on Canvas. Once you turn in your data sheets, the TAs will enter your grade without penalty. If, by the final exam period for the course, you have NOT turned in your data sheets, 10 points will be taken off of EACH LAB GRADE missing data sheets.

Email submissions are not accepted. Reports turned in after 5pm on the due date will be penalized –15% per day late. For some lab groups, laboratory due dates are on Fridays. If reports are turned in on Monday, that is considered 3 days late.

NOTE THAT ONLY INSTITUTE RECOGNIZED EXCUSES ARE JUSTIFICATION FOR EXTENSIONS ON LABORATORY REPORT SUBMISSIONS. The Instructor and TAs empathize with the unforeseen circumstances that can happen to students, but some consistency must be maintained for fairness in the course. It is impossible to judge whether one unfortunate incident is “worse” than another – comparing a problem with one student’s printer delaying his/her report submission versus another student having car trouble on the way to school to turn in their report, to illustrate using examples from previous semesters. *The most effective way to avoid these problems is to get started early on the lab reports, and plan to turn them in early.*

Lab exercises and lab reports are an important learning component in this course. **AS A RESULT, FAILURE TO SUBMIT ALL LAB REPORTS BY THE FINAL EXAM PERIOD FOR THE COURSE WILL RESULT IN A FAILING GRADE FOR THE TERM.** All students must attend each lab exercise and turn in a report for each lab.

Table 1. Meeting times and report due dates for Fall 2021

Lab	Subject	Room	Meeting Date						Due Date					
			Mon 12:30-3:15 B1	Mon 3:30-6:15 B2	Wed 12:30-3:15 B3	Wed 3:30-6:15 B4	Fri 12:30-3:15 B5	Fri 3:30-6:15 B6	Mon 5 pm B1	Mon 5 pm B2	Wed 5 pm B3	Wed 5 pm B4	Fri 5 pm B5	Fri 5 pm B6
1	Aggregate Properties	2140 Mason	8/30	8/30	9/1	9/1	9/3	9/3	9/7	9/7	9/8	9/8	9/10	9/10
2	Proportioning PCC	Structures Lab	9/13	9/13	9/15	9/15	9/17	9/17	9/20	9/20	9/22	9/22	9/24	9/24
3	Hardened Concrete Properties	2140 Mason	9/27 or 10/4 *	9/27 or 10/4 *	9/29 or 10/6 *	9/29 or 10/6 *	10/1 or 10/8 *	10/1 or 10/8 *	Due 10/15 for all groups					
4	Metals: Tension, Hardness and Toughness	2140 Mason	10/18	10/18	10/20	10/20	10/22	10/22	10/25	10/25	10/27	10/27	10/29	10/29
5	Polymers and FRP: Tension	2140 Mason	Lab#5 is assigned on 11/1 for all groups						Due 11/12 for all groups					
6	Creep of Polymers		Lab#6 is assigned on 11/1 for all groups **						Due 12/3 for all groups					

* For Lab#3, two groups per section test at 14 days and 21 days respectively; the two sub-groups will be assigned by your TAs.

** Lab 6 will be designed and carried out by student teams outside of normal laboratory hours. Note that your student team for this exercise will be the same as the one for the other labs.

Weighting: Labs 1,2,3,4 each counts 10%. Lab 5, 6 each counts 5%.